15400 Calhoun Drive, Suite 400
Rockville, Maryland, 20855
(301) 294-5241
http://www.i-a-i.com

Intelligent Automation Incorporated

Coherent distributed radar for high-resolution through-wall imaging

Progress Report 21

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Prepared by
Eric van Doorn, Ph.D. (PI)
Satya Ponnaluri, Ph.D.

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1 Work performed this reporting period

1.1 Technical work performed in this reporting period

During this period of performance, we concentrated our efforts in the following technical tasks

- Processed data collected in different node location configurations for accuracy of the currently implemented algorithm
    - Outdoor
    - Indoor (LOS)
    - Indoor (NLOS)

The currently implemented algorithm is an edge detection algorithm. It sets the base line performance of the current ranging system. In the next reporting periods, we will re-process this data to show the improvement achievable by digital beam forming.

Figure 1 shows the correlation between the actual measured range between the master and the slave and the reported range (One-Time Of Flight, or OTOF) from our system. Our data shows an RMS range error of 2.6 meters for the outdoor case.

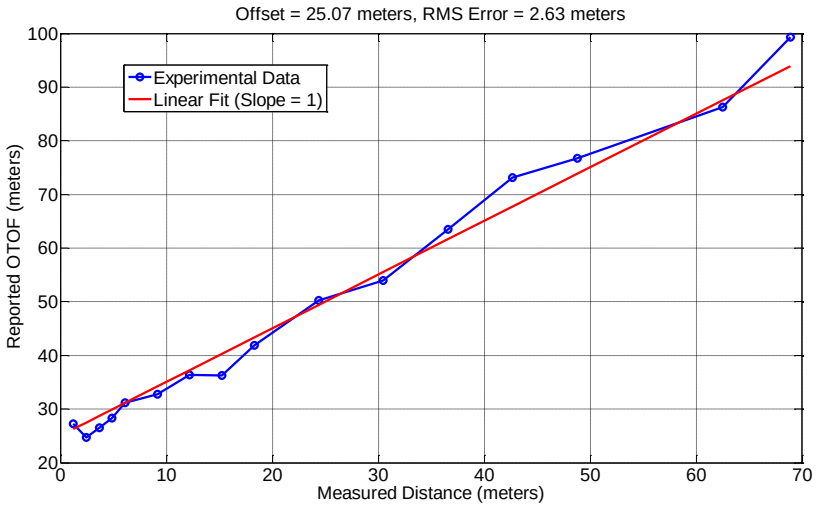

Figure 1. Correlation of measured and reported OTOF data for the outdoor case

We also processed data collected in two indoor configurations: LOS, and NLOS.
The correlation between the actual range and reported OTOF for these two subsets are shown separately in Figure 2. This plot shows that for the non-LOS case, the range has an RMS error of 11.7 meters.

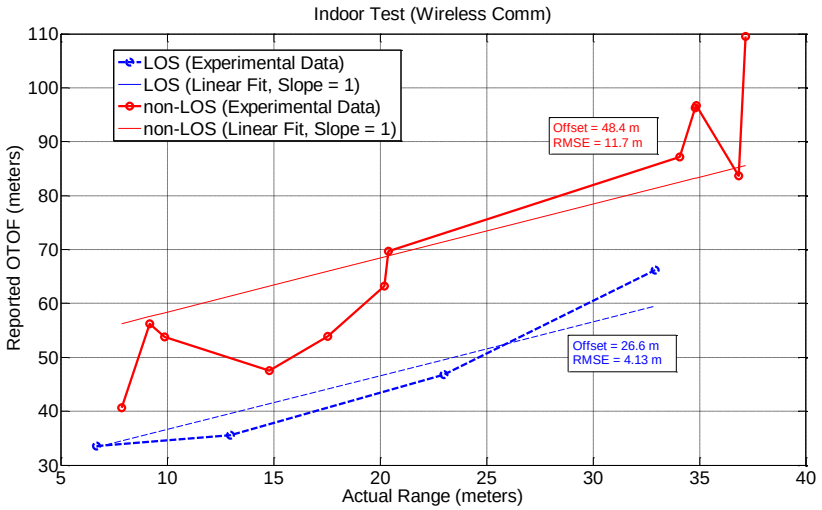

Figure 2. Correlation of measured and reported OTOF data for the indoor case

A second set of data was taken inside the Intelligent Automation building (shown in Figure 3) at similar waypoints. This plot indicates that the system is quite repeatable even for the non-LOS case when the experiment location is the same.

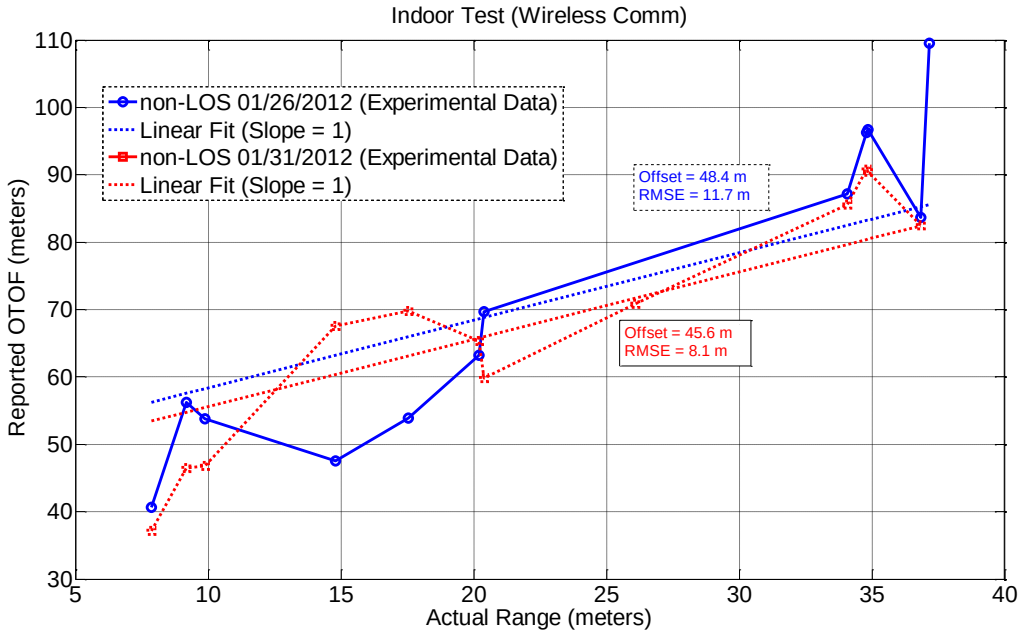

Figure 3. Comparison of two indoor, non-LOS data sets

1.1.1 Range Accuracy Improvement

Currently we are investigating algorithms to improve the range accuracy of our system. The two algorithms that we are studying are:

- Channel Estimation
- Digital beam forming

In addition to recording the reported OTOF during our previous indoor/outdoor experiments, we have recorded the I and the Q data reported by our system. This data will be used to study these algorithms for bi-static radar imaging, and range accuracy improvement.